

(12) UK Patent Application (19) GB (11) 2 286 423 (13) A

(43) Date of A Publication 16.08.1995

(21) Application No 9502507.8

(22) Date of Filing 09.02.1995

(30) Priority Data

(31) 9402500.4

(32) 09.02.1994

(33) GB

(51) INT CL⁶
E05B 45/00 , B60R 25/10(52) UK CL (Edition N)
E2A AAA A115 A160 A190 A420 A554(56) Documents Cited
GB 2246390 A EP 0202146 A1 EP 0006147 A1
US 3789382 A(58) Field of Search
UK CL (Edition N) E2A AAA AAB AAD AAE AAF AAG
INT CL⁶ E05B 45/00 , G08B 13/06 13/16

(71) Applicant(s)

James McCracken
Mains Lodge, Lockfaulds, BEITH, Ayrshire, KA15 2HU,
United Kingdom

(72) Inventor(s)

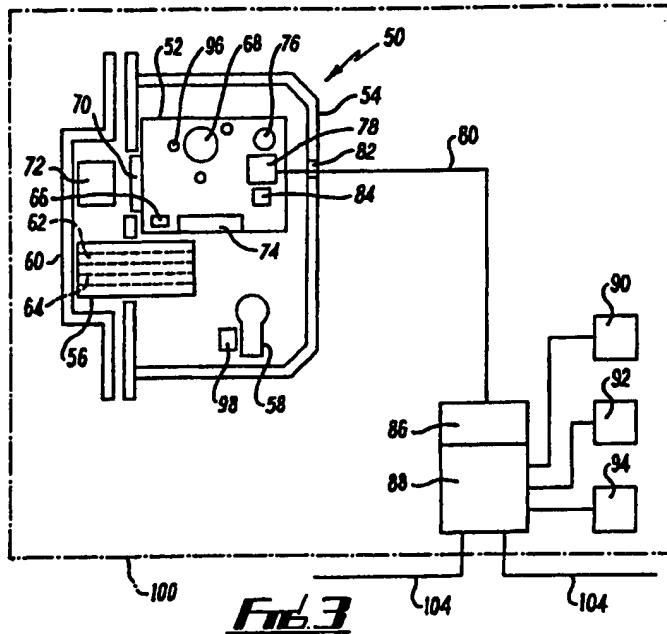
James McCracken

(74) Agent and/or Address for Service

Murgitroyd & Company
373 Scotland Street, GLASGOW, G5 8QA,
United Kingdom

(54) SECURITY SYSTEM

(57) A security lock (50) includes a seismic detector 68 and/or a magnetic detector (66) to detect attempted forced entry, and is adapted to report alarm events to a remote monitoring station (106) via a cable network 104 connecting a number of such locks to a shared network driver (102), which is connected to the monitoring station by modem and telephone line. Each protected property is identified by a unique code. An alarm system incorporating a number of such locks may further include intruder and/or smoke detection means and/or a "panic button" (90, 92, 94) which may also send alarm signals to the monitoring station. The lock may also include sensors for detecting opening and closing of the door (70, 72), operation of the lock (74) and the direction of insertion of a key into the lock (98). The lock electronics are mounted on a printed circuit board (52) located within the lock casing (54).



GB 2 286 423

$\frac{1}{3}$

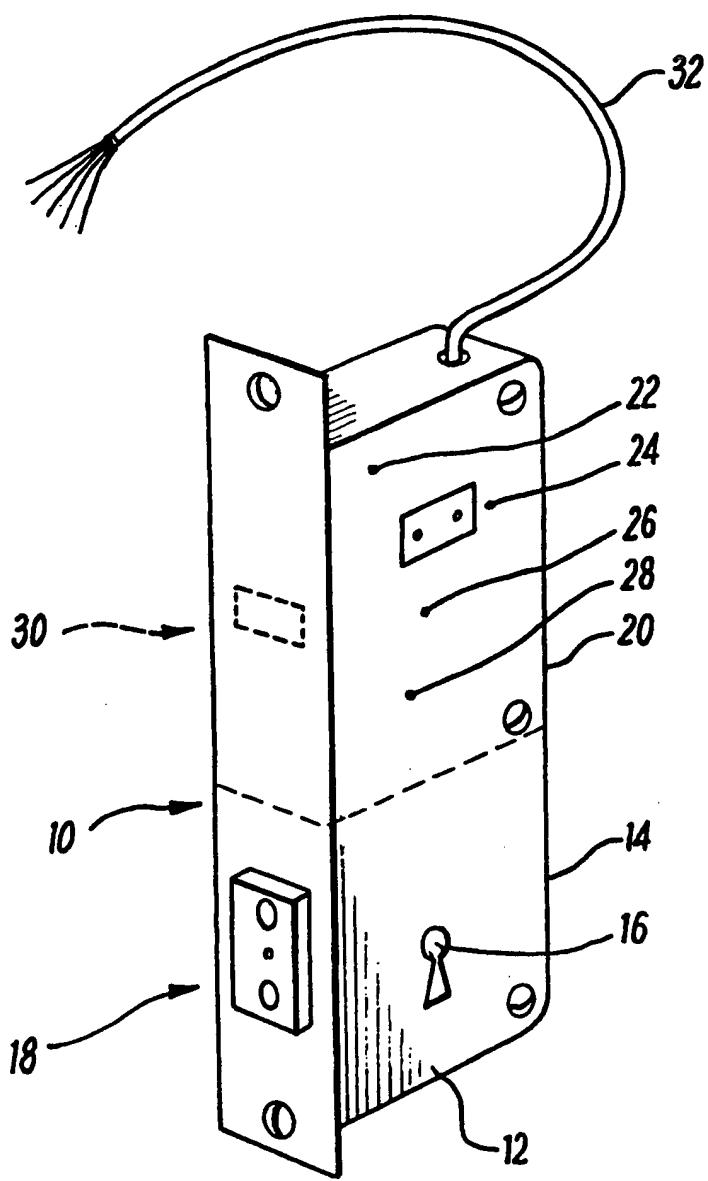


Fig. 1

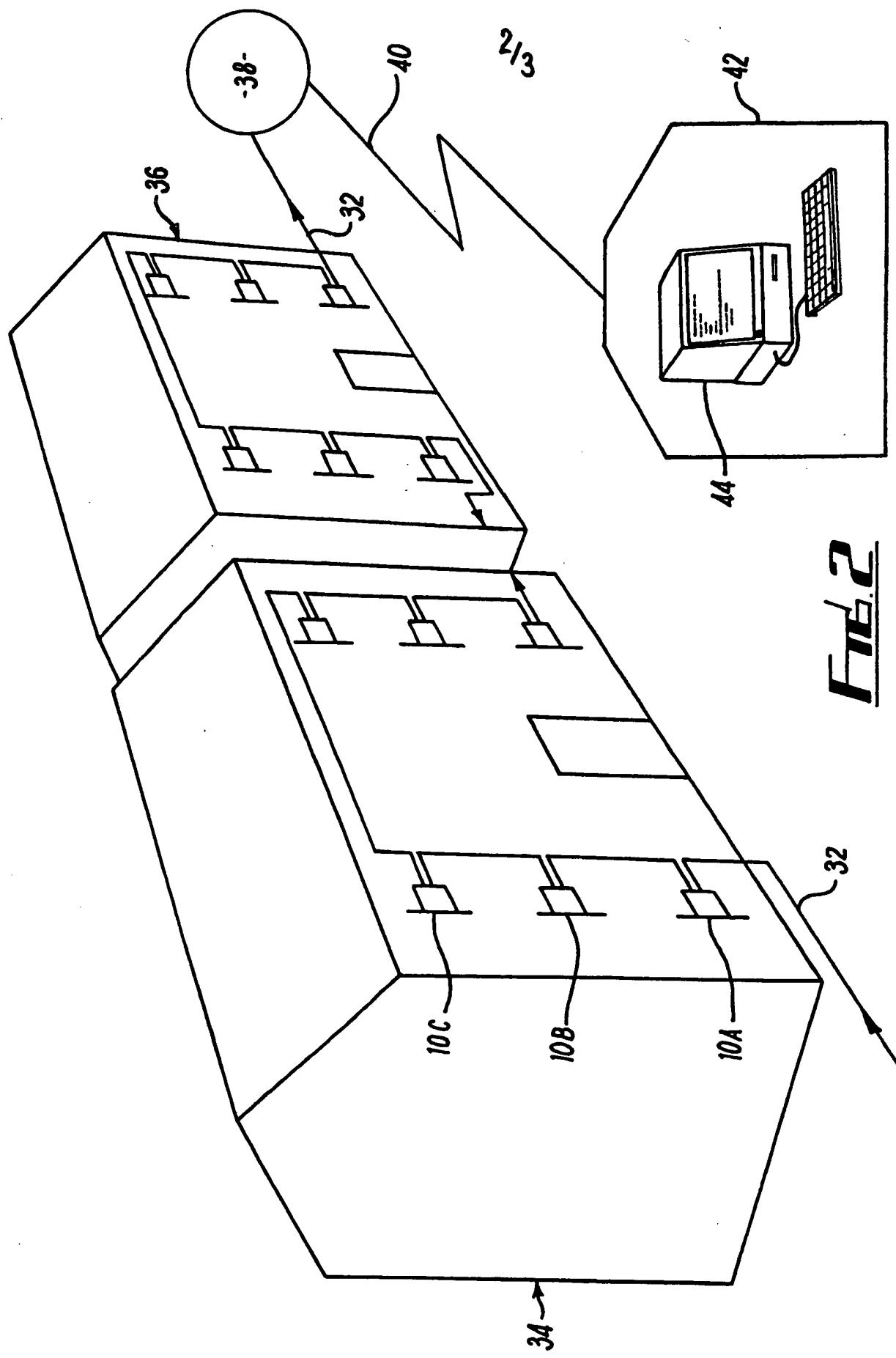


FIG. 2

34 →

3/3

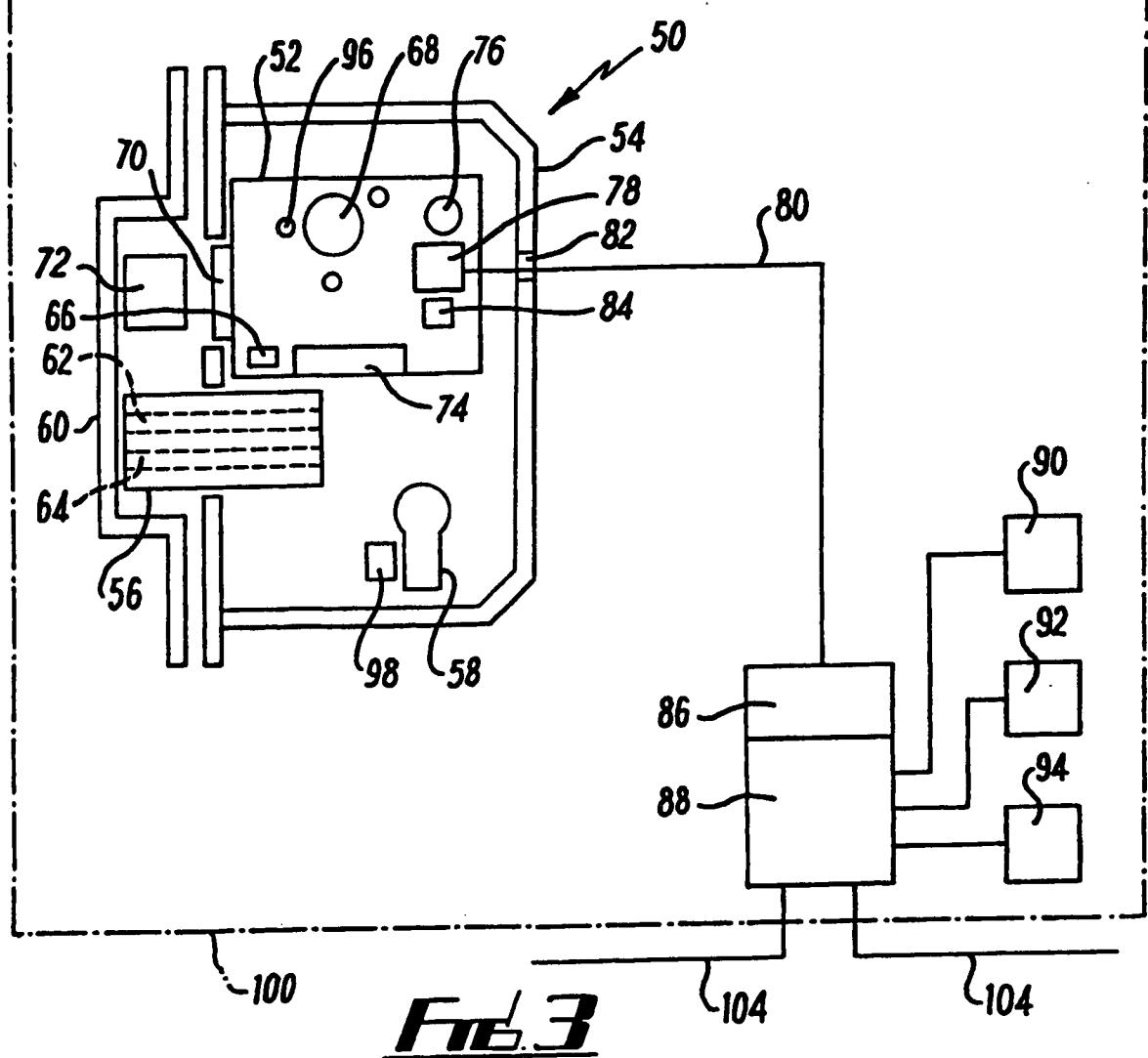


Fig. 3

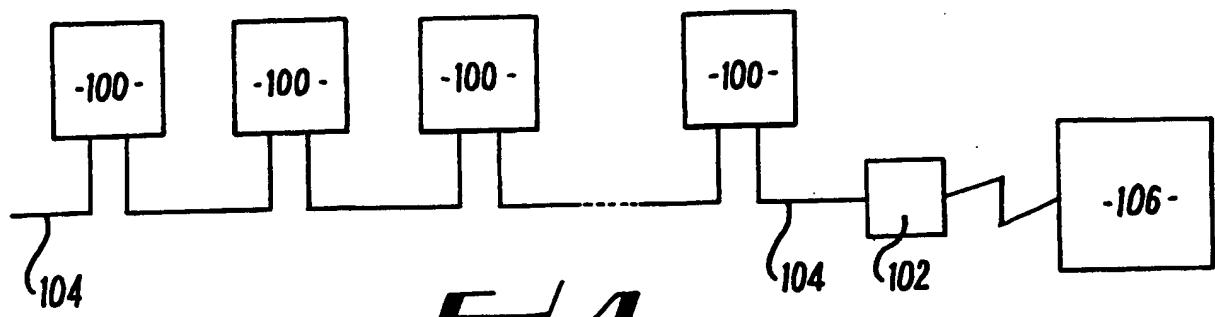


Fig. 4

1 "Security System"

2
3 This invention relates to a security system, for
4 example, a security lock on a door connected to a
5 computer network.

6
7 It is known to provide a security system which sounds a
8 distant alarm; conventional burglar alarm systems may
9 sound an alarm at a remote control point at which
10 several such systems are monitored; ie the systems are
11 networked. However conventional security locks do not
12 themselves detect forced entry, only the entry after
13 the lock has been forced.

14
15 According to the invention a security lock comprises a
16 locking means; means to detect an unauthorised attack
17 on the door; and means to connect the lock to a remote
18 monitoring station.

19
20 The means to detect an unauthorised attack on the door
21 may be a seismic detector, which will detect gross
22 vibration of the door, such as occurs when a potential
23 intruder kicks in the door to force entry.

1 Alternatively, the means to detect an unauthorised
2 attack on the door may comprise a magnetic detector
3 associated with the deadlock mechanism of the lock, to
4 detect forceable opening of the lock, for example by
5 use of a jemmy.

6
7 Alternatively, both a seismic detector and a magnetic
8 detector may be provided.

9
10 Optionally the seismic detector and a magnetic
11 detector, when present, are situated within the casing
12 of the lock.

13
14 Preferably the means to connect the lock to the remote
15 monitoring station is situated within the door, eg
16 between its panels, so that there are no external wires
17 or other connectors which can be severed to disable the
18 system.

19
20 Preferably each lock is provided with coding means so
21 that the individual lock under attack can be identified
22 at the remote monitoring station. Such a system is
23 suitable for use on doors in blocks of flats or housing
24 estates.

25
26 Embodiments of the invention will now be described by
27 way of example only, with reference to the accompanying
28 drawings in which:-

29
30 Figure 1 illustrates schematically a door lock
31 according to the invention;

32
33 Figure 2 illustrates schematically the networking
34 of a number of door locks according to the
35 invention;

1 Figure 3 is a schematic sectional view of a
2 preferred embodiment of a door lock in accordance
3 with the invention, and associated system
4 components; and

5
6 Figure 4 is a schematic representation showing the
7 networking of a number of the locks of Figure 3.

8
9 In Figure 1, a door lock indicated generally by
10 reference 10 comprises a housing 12 which contains a
11 conventional mortice lock in its lower part 14,
12 lockable through a keyhole 16. The deadlock 18 of the
13 mortice lock is provided with a Hall effect device (not
14 shown separately).

15
16 Above its lower part 14 is an upper part 20 which
17 contains within it (but not shown separately) a seismic
18 detector 22; an internal alarm control 24; an internal
19 warning buzzer 26; and an internal addressable customer
20 encoding module 28.

21
22 On the faceplate of the lock above the deadlock is an
23 in-built door contact 30.

24
25 The housing contains appropriate electrical connections
26 which pass out of the housing in a cable 32. The
27 housing is set within a door in the conventional way,
28 and the cable preferably passes through the door and
29 doorframe, to avoid exposure of the electrical
30 connections. The cable 32 is connected to a remote
31 monitoring station, conveniently passing through ducts
32 in walls or under floors.

33
34 There may also be provided a smoke detector also
35 connected through the cable 32 to the monitoring

1 station.

2

3 Figure 2 shows a plurality of door locks 10A, 10B, 10C
4 etc installed on doors to flats in two blocks of flats
5 34, 36. Cable 32 is connected through a connector 38
6 to a telephone or other line 40 and to a remote
7 monitoring station 42 containing a computer 44.

8

9 In operation, the occupier of a flat locks the mortice
10 lock when leaving the premises empty. The security
11 system is then armed.

12

13 If an attempt is made to kick in the door, the seismic
14 detector 22 senses the gross vibrations of the door,
15 and sends an alarm signal through the cable 32,
16 connector 32 and line 40 to the monitoring station 42.
17 The customer encoding module 28 also sends a signal
18 identifying the lock under attack to the monitoring
19 station. It is an advantage of the invention that the
20 warning can be given silently to the monitoring
21 station.

22

23 If the lock is attacked with a jemmy, the magnetic
24 field will be broken, because the Hall effect detector
25 adjacent to the deadlock 18 is arranged to detect when
26 the deadlock has been thrown into the keeper;
27 preferably the arrangement is such that in normal
28 opening with a key, the deadlock opens a very short
29 time before the magnetic field is switched off; the
30 short time may be a few milliseconds; by use of a truth
31 table, an attack on the door can be distinguished from
32 a legitimate opening.

33

34 If there is also provided a smoke detector connected
35 through cable 32 to the monitoring station, warning of

1 fire can be given as well as of an attack on an
2 identified door.

3
4 When the occupier is at home, it is preferable for
5 safety reasons, eg rapid escape if there is a fire, not
6 to lock the mortice lock, but clearly some element of
7 security is required. This is provided by a small
8 switch (not shown) on the side of the housing 12 facing
9 into the flat; there is no keyhole on that side. The
10 switch can be used to set the seismic detector 22. If
11 the seismic detector operates, the internal buzzer
12 sounds; this buzzer also sounds if the smoke alarm
13 operates, and always sounds when the door opens, as
14 detected by the contact 30. The occupant is thus
15 protected and warned of an intruder when at home.

16
17 In addition, the internal alarm control 24 can be used
18 as a panic button; if the occupier presses an
19 associated button (not shown), an emergency help call
20 is registered at the remote monitoring station 42, with
21 the code identifying the lock, and therefore the
22 address, from which the help call originated.

23
24 Preferably the computer 44 in monitoring station 42
25 operates in a polling mode, checking the integrity of
26 all the locks connected to it. For example, 256 locks
27 may be connected, each with an individual identifying
28 code set on the customer encoding modules 28.

29
30 Figure 3 illustrates a preferred embodiment of the
31 invention. The alarm control electronics and sensors of
32 the lock 50 are all mounted on a double-sided printed
33 circuit board (PCB) 52, designed to be enclosed within
34 the upper half of the lock casing 54, above the
35 conventional lock mechanism (not illustrated in

1 detail), which includes a deadbolt 56 and a keyhole 58.
2 The deadbolt 56 engages a lock keeper 60 mounted on the
3 door jamb, and has incorporated therein upper and lower
4 hardened, anti-saw rollers 62, 64.

5

6 In this embodiment, the magnetic sensor to detect the
7 use of a jemmy comprises a Hall-effect Schmitt-trigger
8 device 66 located at the lower edge of the PCB adjacent
9 the upper surface of the deadbolt 56. The lowermost
10 roller 64 is magnetised, so that the use of a ferrous
11 implement to force the lock will cause the magnetic
12 field of the lowermost roller 64 to be coupled into the
13 upper roller 62. This change is detected by the Hall
14 effect sensor 66 to generate an alarm signal. The
15 seismic detector in this case is a piezoelectric device
16 68 mounted on the PCB 52.

17

18 Opening and closing of the door is detected by a reed
19 switch 70 mounted on an edge of the PCB 52 facing a
20 magnet 72 located in the lock keeper 60 in a space
21 above the deadbolt 56. This arrangement obviates the
22 need for separate cabling to the door jamb. Operation
23 of the lock 50 is detected by a switch 74, located
24 beside the Hall effect sensor 66 on the lower edge of
25 the PCB 52, which operates in response to movement of
26 the deadbolt 56. An integral piezoelectric sounder 76
27 is also mounted on the PCB 52, and a connector block 78
28 allows connection to the external system, suitably via
29 a six-conductor ribbon cable 80 which exits the casing
30 54 via a slot 82. The cable 80 may be connected to the
31 rest of the system via a "contact hinge" fitted to the
32 door, as an additional anti-tamper measure. The PCB 52
33 also includes a micro-switch 84 for setting up the
34 alarm system.

35

1 The reverse side of the PCB 52 (not shown) carries
2 conductors connecting the above mentioned components
3 together with additional discrete surface-mount
4 components and integrated circuits (not shown),
5 including a Programmable Integrated Circuit (PIC)
6 providing control logic for operation of the alarm
7 system, including anti-false-alarm and can't-set
8 functions.

9
10 The casing 50 of the lock typically includes hardened
11 steel anti-drill plates, which protect the electronics
12 as well as the mechanical lock mechanism itself.

13
14 The cable 80 is connected to a tenant-identification
15 module (TIM) 86 located within the dwelling, which has
16 a unique network address (suitably an eight-digit
17 binary number set by a DIP-switch within the TIM 86).
18 In this example, the TIM 86 forms part of a power
19 supply unit (PSU) 88, suitably providing a 12V dc
20 supply and including a sealed lead acid back-up
21 battery. The PSU is powered from the dwelling's own
22 power supply, but PSU's on the network can be
23 interlinked so as to maintain power in each dwelling
24 even if the power supply is turned off for extended
25 periods (eg. if the dwelling is vacant). In a variation
26 of the system, a number of individual dwellings could
27 have their own TIM's connected to a shared PSU.

28
29 Each dwelling may also be provided with other sensors
30 such as a smoke detector 90 and a passive infra-red
31 detector (PIR) 92, together with a "panic" switch 94,
32 which are all connected to the network via the TIM/PSU
33 86/88 and may be set simply by operation of the lock
34 50.

35

1 The seismic detector 68 is preferably of the multi-
2 count, programmable type. The output signal from the
3 seismic detector may be processed by the control logic
4 to minimise false alarms. The set-up switch 84 is
5 accessible through an opening (not shown) in the casing
6 54 and allows the lock to be switched to a set up mode
7 in which the sensitivity of the detector 68 may be
8 adjusted by means of a variable resistor 96, which is
9 also accessible via a further opening (not shown). The
10 sounder 76 may be employed in the set up mode to assist
11 in setting the sensitivity by providing different audio
12 signals (including different numbers of "pips" and
13 different signal frequencies), in response to different
14 levels and types of vibration (eg. multiple knocks
15 within a particular period). In its normal operational
16 mode, the system can also be adapted to produce
17 different alarm conditions in response to different
18 vibrations.

19
20 The set-up switch 84 might also be used to set further
21 modes of operation, such as an "unoccupied" mode for
22 use where a dwelling is vacant for an extended period
23 of time. In this mode, the system may report every time
24 the door is opened and closed, providing a log of
25 access to the property.

26
27 The system electronics may also include an event log to
28 record alarm events, which may yield useful information
29 if there were multiple attempted break-ins at different
30 dwellings on the network.

31
32 As noted in relation to the first embodiment, it is
33 desirable that the system be set in differing modes
34 depending upon whether the dwelling is occupied or not.
35 In the first embodiment the lock has no keyhole on its

1 inner side, and the system is set in "occupied" mode by
2 operation of a separate switch within the dwelling. In
3 many cases, however, it will be desirable that the lock
4 can be operated from inside the dwelling. In this case,
5 different modes can be set by operation of the lock by
6 detecting the direction from which the key is inserted
7 in the keyhole. For this purpose, a suitable sensor 98
8 may be incorporated into the lock 50 to detect the
9 direction of insertion of the key. This might be an
10 optical or infra red transmitter and receiver, or other
11 suitable sensor as will be apparent to those skilled in
12 the art. If the lock is operated from outside, the
13 system would typically be fully armed; if locked from
14 the inside, only certain sensors and functions would be
15 enabled.

16
17 The ability to detect the direction of entry of the key
18 also provides the basis for detecting attempts to pick
19 the lock; the system may be adapted to generate an
20 alarm if an implement is inserted into the lock from
21 "outside" and remains in the lock for a time greater
22 than a predetermined period (eg 20 seconds).

23
24 The "panic" switch 94 can be used to send an alarm
25 signal over the network regardless of whether the alarm
26 system is enabled. The smoke detector 92 can be powered
27 by the PSU 88, avoiding the problem of an internal
28 battery failing or being removed.

29
30 Figure 4 illustrates the networking of a number of
31 properties. The blocks 100 correspond to the apparatus
32 located at each dwelling, as indicated by the dashed
33 line in Figure 3. The individual units 100 are
34 connected to each other and to a network driver 102 by
35 means of a "data highway" 104. A 3-core data highway is

1 sufficient for the necessary power and data
2 connections, but a standard 6-core cable is preferred
3 to provide complete redundancy for all of the power and
4 data circuits. The network driver is connected to the
5 monitoring station 106 by a modem and standard PSTN
6 telephone line.

7
8 The network driver 102 is the intelligent interface
9 which collects information from each unit 100 on the
10 circuit, and may be adapted from an industry standard
11 data collector. It may be either analogue or digitally
12 addressable. It acts as a dumb terminal and in this
13 application need have no operator controls. However,
14 local set-up commands can be carried out via an
15 engineering keypad, or remotely from the monitoring
16 station 106. Typically, the network driver might
17 support up to 50 units 100 with four channels per TIM
18 86, and up to 2000m of data highway 104. It is not
19 necessary to use screened cable. Typically, the network
20 driver may be capable of logging up to 300 events with
21 times and dates, and may include a serial input/output
22 port for connection of a local printer.

23
24 The network driver communicates with the monitoring
25 station 106 in the event of an alarm. The monitoring
26 station 106 may be a personal computer equipped with
27 modems. The monitoring station 106 may also download
28 commands to the network driver 102, for example to
29 operate relays at remote sites controlling lights,
30 sounders, cameras or the like which might also be
31 connected to the system. The network driver 102 can
32 also report faults or damage in the network cabling to
33 the monitoring station 106.

34
35 The system is arranged such that the alarms are set

1 simply by the operation of the lock when the tenant
2 leaves the protected property. When the key is turned,
3 the sounder 76 preferably operates for a period
4 (suitably 10 seconds) prior to connecting to the
5 network, whereafter the property is protected. If an
6 alarm signal is detected during this period (eg from
7 air turbulence affecting the PIR unit 90) then the
8 sounder will switch to an intermittent tone (indicating
9 "can't set") and the setting procedure is aborted.

10
11 Opening and relocking the door will initiate a second
12 attempt to set the system and access the network. If
13 repeated attempts to set the system fail, the sounder
14 will sound for a longer period (eg 30 seconds) to
15 indicate that there is a fault and that the system is
16 not operational.

17
18 When the system is set from inside the property
19 (whether by operation of a separate switch or by
20 operation of the lock from inside), the sensors on the
21 lock will be activated together with certain other
22 system sensors; eg selected PIR units if there are
23 multiple units in the property. In this case, certain
24 alarm conditions may result only in the local sounder
25 being activated, with no network alarm signal. This
26 will minimise false alarms. Operation of the panic
27 switch 94 or smoke detector will always result in a
28 network alarm.

29
30 The lock might further include a microphone (not
31 shown), which would allow activity within the property
32 to be monitored in the event of an alarm. The
33 microphone output would only be accessible when the
34 lock had been operated from the outside.

35

1 It is a great advantage of a security system according
2 to the invention that security can be provided
3 economically to a large number of adjacent domestic
4 dwellings. It is an advantage of a security lock
5 according to the invention that the security system is
6 not easily accessed, even when a door has been broken
7 down. further, an alarm is given before the door is
8 opened by an intruder.

9

1 Claims

2
3 1. A security lock comprising a locking means; means
4 to detect an unauthorised attack on the door; and means
5 to connect the lock to a remote monitoring station.

6
7 2. A security lock as claimed in Claim 1, wherein the
8 means to detect an unauthorised attack on the door
9 comprises a seismic detector.

10
11 3. A security lock as claimed in Claim 2, wherein
12 said seismic detector is adapted for detecting gross
13 vibration of the door.

14
15 4. A security lock as claimed in Claim 2 or Claim 3,
16 wherein said seismic detector comprises a piezoelectric
17 device.

18
19 5. A security lock as claimed in any preceding Claim
20 1, wherein the means to detect an unauthorised attack
21 on the door includes a magnetic detector associated
22 with the deadlock mechanism of the lock, to detect
23 forceable opening of the lock, such as by use of a
24 jemmy.

25
26 6. A security lock as claimed in Claim 5, wherein
27 said magnetic detector comprises a Hall effect device.

28
29 7. A security lock as claimed in Claim 6, wherein the
30 locking means includes a deadbolt having upper and
31 lower hardened rollers, one of said rollers being
32 magnetised, and said Hall effect device being located
33 adjacent the non-magnetised roller.

34
35 8. A security lock as claimed in any preceding Claim,

1 further including means for detecting the opening and
2 closing of a door in which the lock is mounted, in use.
3

4 9. A security lock as claimed in Claim 8, wherein
5 said means for detecting the opening and closing of the
6 door comprises a reed switch mounted to operate in
7 response to the proximity of a magnet located in a
8 keeper portion of the lock mounted on the door jamb, in
9 use.

10
11 10. A security lock as claimed in any preceding Claim,
12 further including means to detect operation of the
13 lock.

14
15 11. A security lock as claimed in Claim 10, wherein
16 said means to detect operation of the lock comprises a
17 switch located adjacent a deadbolt forming part of the
18 locking means.

19
20 12. A security lock as claimed in any preceding Claim,
21 wherein the means to detect an unauthorised attack on
22 the door, and other detection means where fitted, are
23 situated within the casing of the lock.

24
25 13. A security lock as claimed in Claim 12, wherein
26 said means to detect an unauthorised attack on the
27 door, and said other detection means where fitted, are
28 mounted on a printed circuit board located in an upper
29 portion of said casing above the locking means.

30
31 14. A security lock as claimed in any preceding Claim,
32 further including means to detect the direction in
33 which a key is inserted into the lock.

34
35 15. A security lock as claimed in Claim 12, wherein

1 said means to detect the direction of insertion of the
2 key comprises a sensor located adjacent the keyhole of
3 the lock.

4

5 16. A security lock as claimed in any preceding Claim,
6 further including an audio sounder device.

7

8 17. A security lock as claimed in any preceding Claim,
9 wherein the means to connect the lock to the remote
10 monitoring station is situated within the door so that
11 there are no external wires or other connectors which
12 can be severed to disable the system.

13

14 18. A security lock as claimed in any preceding Claim,
15 wherein each lock is provided with associated coding
16 means so that the individual lock under attack can be
17 identified at the remote monitoring station.

18

19 19. A security lock as claimed in Claim 18, wherein
20 said coding means is located in a unit separate from
21 the lock, within the property to be protected by the
22 lock.

23

24 20. An alarm system incorporating at least one
25 security lock as claimed in any preceding Claim, in
26 which each lock is connected, via coding means
27 identifying each individual lock, to a remote
28 monitoring centre.

29

30 21. An alarm system as claimed in Claim 20, wherein a
31 number of locks are connected to a shared network
32 driver unit, and said network driver unit is connected
33 to said monitoring station.

34

35 22. An alarm system as claimed in Claim 20 or Claim

1 21, wherein each lock has an associated power supply
2 unit.

3
4 23. An alarm system as claimed in Claim 20, Claim 21
5 or Claim 22, wherein each protected property is further
6 provided with intruder detector means, and/or smoke
7 detector means and/or an emergency call button,
8 connected to said monitoring station.

9
10 24. An alarm system as claimed in Claim 23, in which
11 the system can be set in different modes of operation
12 depending upon whether or not individual protected
13 properties are occupied.

14
15 25. A security lock substantially as hereinbefore
16 described with reference to the accompanying drawings.

17
18 26. An alarm system substantially as hereinbefore
19 described with reference to the accompanying drawings.

20

Relevant Technical Fields

(i) UK Cl (Ed.N) E2A (AAA, -B, -D, -E, -F, -G)

(ii) Int Cl (Ed.6) E05B 45/00; G08B 13/06, 13/16

Search Examiner
A ANGELE

Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Date of completion of Search
3 MAY 1995Documents considered relevant following a search in respect of Claims :-
ALL

Categories of documents

X: Document indicating lack of novelty or of inventive step.

P: Document published on or after the declared priority date but before the filing date of the present application.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

A: Document indicating technological background and/or state of the art.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2246390 A	(SUNAMI)	1, 10, 12 14, 15, 17 at least
X	EP 0202146 A1	(FERCO)	1 to 3 at least
X	EP 0006147 A1	(HEILAND)	1 to 4, 11 to 13 at least
X	US 3789382 A	(WARREN) see whole document in each case	1, 5, 10 to 12, 19 20 at least

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.